

(i) THE SUN'S ENERGY AND ITS VARIATION

(ii) | THE RADIATION EXPERIMENT OF PROJECT BOMEX

By A. J. Drummond

Dr. Drummond, Chief Scientist of the Eppley Radiation Laboratories, also in Melbourne to attend the Conference, gave two talks on the above subjects concerned with radiation.

(i) Dr. Drummond commenced his first topic by relating that the programme to redetermine the solar constant originated in 1965 with the realisation that the failure of circuitry in Venus- and Mars-bound spacecraft had resulted from an incorrect assessment of the heat balance for the space craft coatings. From this began a four year cooperative programme between Eppley Laboratories and scientists of the Jet Propulsion Laboratories, Pasadena - an effort which led to an extensive US programme of high altitude aircraft and balloon measurements and, according to Dr. Drummond, has greatly advanced the art of filter measurements.

The speaker discussed in some detail the design of the instruments and filters (narrow and broad band) and stressed the problems involved in transfer of calibration as well as the checking of the U.S. IPS standard with the necessary precision. Over a 15-year period six checks with the Davos standard indicated a consistency to two parts in 1000. After a number of other checks it was concluded that the International Pyrheliometric Scale (IPS) as reproduced at Newport (Eppley) is correct to within $\frac{1}{2}\%$.

Dr. Drummond showed a series of slides illustrating aspects of the calibration, details of the aircraft mounting systems, the B57 and X15 aircraft, the data logging systems and flight paths. Then followed a summary of several measurements of the total solar irradiance as well as its infrared, visible and ultraviolet components. Their internal agreement was considered excellent (values of 1358, 1360, 1362, 1360, 1361 and 1360 watts metre⁻² for the total radiation), and values determined effectively above the atmosphere closely agreed with measurements from within the atmosphere corrected for absorption. The visible and ultraviolet radiation was found to be 7% smaller than Johnson's (1954) value and the total value $2\frac{1}{2}\%$ lower (Johnson's value 1396 watts metre⁻²).

Dr. Drummon discussed some high mountain measurements of the solar irradiance and then moved to a discussion of measurements made by somewhat different techniques at Goddard Space Flight Centre. These confirmed the revised values for the solar constant.

(ii) The speaker discussed briefly and informally the radiation programme and some preliminary results of the BOMEX experiment. He illustrated with slides the instrumented ships and aircraft used, the sensor mountings and the data acquisition methods. A significant result has been the determination of sea-surface albedo as a function of latitude, solar elevation and wave height. Another has been the confirmation, via measurements at different altitudes, of the importance of aerosol absorption.

In the ensuing discussion Dr. Drummond was asked about the present best values for the Stefan-Boltzmann constant and the longwave emissivity of sea water. He replied that there was uncertainty in both and pointed out that almost all of the work he had reported used absolutely calibrated instruments. Asked if previous advocates of higher solar constant values now accepted the return to the original (Abbot) value of $1.94 \text{ calories cm}^{-2} \text{ min}^{-1}$. Dr. Drummond pointed out that Dr. Abbot was delighted to hear of the new experimental results but was less implicit on Dr. F.S. Johnson's assessment of the present situation.

Mr. E. L. Deacon asked about vibration problems with aircraft-borne radiation sensors and the speaker replied these were slight with jet aircraft but presented quite a problem with the piston engined DC4's and DC6's.

Reference

Johnson, F.S., 1954 J. Meteorol., 11, pp.431-439.

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